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ABSTRACT

The purpose of this study was to explore the value of variables beyond undergraduate grades and admission test scores in predicting success in the preclinical curriculum of the College of Human Medicine of Michigan State University (East Lansing). Subjects included about 93 students with relatively low scores on the Medical College Admissions Test (MCAT). Admissions folders were located for students who entered the University between 1979 and 1984 with MCAT scores less than 8. The number of quarter hours "incomplete" and types/numbers of courses from which students "withdrew" were determined via an analysis of undergraduate transcripts. The written comments of admissions interviewers were reviewed, and notations regarding four characteristics (motivation, analytic skill, self-organization skill, and skill in maintaining a clear focus on study or on other valued activities) that received more than occasional comment were noted. Science MCAT scores and total undergraduate grade point average, "no credit" grades received in the preclinical curriculum, scores from initial attempts on Part I of the examination of the National Board of Medical Examiners (NBME), and the delay (in months) between June of the second year of matriculation and date when NBME Part I was first attempted were analyzed. Results indicate that non-academic variables derived from admissions interviews provide very limited gains in prediction. One figure and four data tables are included. (TJH)

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IMPROVED PREDICTION, FOR MEDICAL STUDENTS WITH LOW MCATS, OF INDICES OF PRECLINICAL PERFORMANCE

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PURPOSE

The purpose of this study was to explore the value of variables beyond undergraduate grades and admissions test scores in predicting success in the preclinical curriculum of the College of Human Medicine of Michigan State University for a group of students with relatively low scores on the Medical College Admissions Test (MCAT).

BACKGROUND

During the admissions process professional schools may evaluate some personal and social characteristics which are not strongly associated with academic success, in an attempt to assure the presence of desirable professional characteristics in their graduates. For example, in the admissions process for the College of Human Medicine of Michigan State University an assessment has been made of "tolerance of ambiguity," "self appraisal skills," and "life problem solving" among other characteristics of interest in prospective students. Indicators (such as undergraduate grades and aptitude test scores) of the ability to learn the content of the profession's subjects are also important in the admissions decision, but not infrequently a candidate will present both very desirable non-academic characteristics and academic indicators that raise questions about the prospects of academic failure during training. There is a substantial published literature (e.g., Nowacek et al, 1987), indicating that admissions test scores and undergraduate grades both provide some prediction of medical students' academic performance, particularly their performance in the first two years of medical school. Together, MCAT scores and indices based on undergraduate grades can usually provide a multiple R of .5 to .7. However, once a well-classified set of undergraduate grades and the full range of admissions test scores have been used for prediction, little more is typically gained from further use of test scores or prior grades.

[1] James Haf, Ph.D., Carrie Jackson, Ph.D., and Sandra Isaacson provided invaluable help in assembling the data needed for this study.

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If prediction of academic success could be improved, fewer admitted students would later be acknowledged, after much "wear-and-tear" on the student and the institution, to have failed, and fewer candidates for admission would be mistakenly rejected because of concerns over their prospects for academic success. Two alternative sources of predictors of academic adequacy were of interest, given the data available on students admitted to MSU's College of Human Medicine. A number of investigators have suggested use of a range of nonacademic variables projected to determine the deployment of scholastic abilities (e.g., Tracey and Sedlacek, 1985). Jackson and Dawson-Saunders (1987) found that the likelihood of academic difficulty in the first year at Southern Illinois University School of Medicine was associated with the frequency of withdrawal from or receipt of an "Incomplete" grade in undergraduate courses.

The records of admissions interviews for MSU's College of Human Medicine often contain written reactions and comments by the interviewer. Many of the written comments are related to a range of characteristics and experiences of the candidates that are not rated but that might be related to academic performance. The undergraduate transcript contains the information needed to assess the frequency of withdrawals and incompletes in undergraduate courses. Thus, the admissions folder of admitted College of Human Medicine students, when linked to a set of indices of medical school performance, can provide the data needed to assess the probable predictive value of a candidate set of non-academic variables, and of frequency of non-completion of undergraduate courses. Because some of the most troublesome admissions decisions involve otherwise attractive students with low values of standard academic predictors, the study was focused on students whose average MCAT scores were less than 8. MCAT scores are reported (Mitchell, 1987) to be most predictive within this group of students.

METHODS

Admissions folders were located for students who entered MSU's College of Human Medicine between 1979 and 1984 and whose MCAT average score was less than 8. In each folder the number of term (quarter) hours "incomplete" and "withdrew" in undergraduate transcripts were determined. In addition, the written comments of admissions interviewers were reviewed and a record made of notations (both positive and negative) regarding four characteristics that received more than occasional comment. The four were: motivation to be a student of medicine (indexed by references to persistence, initiative, and special effort in pursuing studies relevant to medicine), analytic skill or disposition (indexed by references to quality of thought, analysis, or problem solving in the interview), skill or disposition in self-organization (indexed by references to practical prioritization or specific achievement gained through organization), and skill or disposition in maintaining a clear focus on study or on other valued activity (indexed by references to goal-directedness and resistance to diffusion of effort). Examples of notations recorded in each category are displayed in Figure 1. The

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Figure 1 around here

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notations in each category were counted, and the counts normalized to correspond to two admissions interviewers (the typical number). For each student in the group, Science MCAT scores and total undergraduate grade point average were also entered. If available, the score from the student's first try on Part I of the examination of the National Board of Medical Examiners, and the best score, if different, were also recorded. A note was made of the delay (in months) between June of the second year of matriculation and the date when NBME Part I was first attempted. Finally, a record was made of the number of "N" (No credit) grades received in the preclinical curriculum.

To reduce the number of predictors, variables that were logically related or that were both conceptually and empirically related (Pearson r's of .3 or greater) were combined. This produced the following set of predictors whose value was being tested:

-The number of course credit hours unfinished within the term of enrollment as an undergraduate (#_UNFIN), the sum of the hours incomplete and withdrew

-The number of positive notations less the number of negative notations related to motivation (MOTIV)

-The number of positive notations less the number of negative notations related to analytic skill/disposition (ANALYTIC)

-The number of positive notations less the number of negative notations related to personal organization (ORGANIZ)

-The number of positive notations less the number of negative notations related to personal focus (FOCUS)

The frequency of agreement between interviewers in the number of notations in a specific area was noted, and compared to the agreement that would be expected if each interviewer had produced notations randomly at a rate consistent with the observed number of notations.

For each of four variables indexing an important aspect of academic performance in the preclinical curriculum (first score on NBME Part I--NBME_1ST; best score on NBME Part I--NBME_TOP; the delay between June of the second year and the date of first try on Part I--DELAY; the number of N grades--#_OF_N'S) a regression analysis was performed. MCAT Science scores (MCAT_SCI) and total undergraduate GPA (TOT_GPA) were always entered first, so the question asked was always whether inclusion of the other variables added significantly to the prediction available from these commonly used predictors.

Data on NBME scores, MCATs, undergraduate GPA and the number of undergraduate course credits unfinished were available for 93 students. However, for 8 of these students the number of N grades had not been recorded, and for a different 15 the admissions rating data could not be located. Thus the sample size for different regression analyses changed with the outcome index and the predictor variables that were being examined.

RESULTS

The correlations among the indices of performance are shown in Table I. Aside from the correlation between the two sets of NBME scores, the strength of association

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TABLE I about here

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among the performance indices is moderately small, indicating their relative independence. The number of N's received is positively related to the length of the preclinical program (Delay) and negatively related to the NBME scores, as expected. The very large correlation between the two sets of NBME scores can also be expected, since the scores are different only for students who took Part I more than once.

Correlations between the outcome indices and the predictors, and those among predictors, are shown in Table II. For each performance index there is a single best

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TABLE II about here

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predictor, and it is a summary of earlier behavior of the same kind. The number of unfinished undergraduate credits correlates strongly with the length of students' preclinical programs, and negatively, and more weakly, with the NBME scores. Correlations with variables derived from the notes of admissions interviews were weak (never greater than .3), although they were generally in the expected direction. Agreement in frequency of notation between interviewers was not significantly different from what would be expected by chance for any of the variables derived from notations made by admissions interviewers. The notations counted in these variables were fairly rare events, so the mean of each of the variables was less than 1.

The contribution to prediction made by the number of unfinished undergraduate credits is summarized in Table III, where the impact of adding #_UNFIN to the

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TABLE III about here

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prediction equation is shown for each of the performance indices. Knowledge of the number of undergraduate credits withdrawn from or taken as "incomplete" significantly improves the prediction of students' delay in taking NBME, Part I, and of students' best Part I scores. The F associated with adding #_UNFIN to the prediction of students' first scores on Part I is greater than 1, but not large enough for statistical significance (with alpha = .05).

Table IV records those instances in which there was an F greater than 1 associated with adding to prediction a variable based on notes made by admissions interviewers. Three (MOTIV, ORGANIZ, and FOCUS) of the four variables developed from admissions interview notations were related to a delay in taking NBME, Part I, and the FOCUS variable makes a significant contribution to prediction of that delay even after Science MCAT, undergraduate GPA, and the number of unfinished undergraduate

TABLE IV about here

course hours (see below) have been entered in the prediction equation. Notations related to motivation produced an F greater than 1 in predicting the number of N grades received, but did not improve that prediction significantly (alpha = .05).

DISCUSSION

The pattern of correlations observed here is consistent with the general rule that "like predicts like." Correlations among test scores are highest, undergraduate GPA is the best single predictor of the number of N grades received in the preclinical curriculum, and undergraduate withdrawals and incompletes (actions that delay completion of the undergraduate curriculum) correlate best with delays in completing the preclinical curriculum.

The results of this study support and extend those of Jackson and Dawson-Saunders(1987); tendency to leave courses uncompleted as an undergraduate is a useful predictor of behavior as a medical student and adds significantly to the ability to predict the best NBME Part I score of students who enter medical school with low MCATs. The set of performance indices examined in this study is not the same as the set studied by Jackson and Dawson-Saunders, but in each case tendency to leave courses uncompleted is an indicator of an unwanted outcome. Faced with an attractive candidate with an equivocal prediction of success from the undergraduate GPA and MCAT scores, a medical school admissions committee may well consider an acceptance if the undergraduate record shows few incompletes and withdrawals. Conversely many instances of failure to complete undergraduate courses may suggest a rejection if the rest of the record is not decisive.

In contrast to the apparent utility of measures of unfinished undergraduate study, the nonacademic variables derived from the admissions interviews have produced very limited gains in prediction. These four variables, measured as they were, add only marginally in predicting performance indices for the preclinical curriculum. However, the weakness of these variables as predictors may stem from inconsistencies of measurement due to the post hoc definition of the variables and to their assessment over a set of observations and records that were not focussed on and had no systematic connection to the constructs of the variables. (Admissions interviewers were not asked to specifically attend to or record observations related to the areas central for each of the variables studied here; interviewers were trained to focus on and rate a set of behavioral tendencies expected to anticipate applicants' style of medical practice.) The variables of this study would almost certainly be better assessed if each interviewer were instructed to ask questions during the interview, about issues inherent in the variables and if interviewers had been brought to a common framework indicating what incidents or reactions were worth recording and which were not. While the variables, as measured, don't add significantly to prediction, their pattern of correlation with the other variables makes sense. Thus, it seems likely that if the variables were better assessed they would prove to be more useful adjuncts to prediction.

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Motivation (persistence, initiative, special effort)

Biochem research on weekends
Little energy or enthusiasm (-)

Analytical (quality of thought, analysis, problem solving)

Able to pick out important facts and use them
Often went on a tangent (-)

Organization (practical prioritizing, achievement thru organization)

Able to prioritize
Ability for self-instruction weak (-)

Focus (Goal-directedness, resistance to diffusion)

Clear about goals

Figure 1. Examples of notations made by interviewers

TABLE I

Correlations Among Performance Indices

	# of Ns	Delay	NBME_1st
Delay	.25		
NBME_1st	-.36	-.31	
NBME_Top	-.23	-.44	.81

TABLE II

Correlations Among Predictors and With Performance Indices

	MCAT_Sci	Tot_GPA	#_Unfin	MOTIV	ANALY	ORGANIZ	FOCUS
# of Ns	-.21	-.44	.02	-.20	-.02	.04	.03
Delay	-.28	-.23	.51	-.17	.07	-.24	-.22
NBME_1st	.52	.37	-.27	-.02	.17	.05	.03
NBME_Top	.56	.24	-.33	.09	.10	-.06	.13
MCAT_Sci		.22	-.15	.02	.01	-.04	.00
Tot_GPA			-.27	.14	.17	.14	.03
#_Unfin				-.03	-.12	-.20	-.05
MOTIV					.26	-.03	.17
ANALY						.14	.06
ORGANIZ							.09

(Sample size = 70)

TABLE III

Predictions of Performance Indices In Which
Number of Unfinished Credits Is Added to the Predictors

Prediction of # of Ns (Sample size = 85)

Entry Order	Variables	R	F	p
1 & 2	MCAT_Sci & Tot_GPA	.42	8.9	<.001
3	#_Unfin	.43	<1	

Prediction of Delay (Sample size = 93)

Entry Order	Variables	R	F	p
1 & 2	MCAT_Sci & Tot_GPA	.35	6.2	.003
3	#_Unfin	.47	11.3	<.005

Prediction of NBME_1st (Sample size = 93)

Entry Order	Variables	R	F	p
1 & 2	MCAT_Sci & Tot_GPA	.55	19.1	<.001
3	#_Unfin	.56	2.4	>.05

Prediction of NBME_Top (Sample size = 93)

Entry Order	Variables	R	F	p
1 & 2	MCAT_Sci & Tot_GPA	.48	13.7	<.001
3	#_Unfin	.53	6.2	>.02

TABLE IV

Prediction of Performance Indices in Which
Addition of a Variable Based on Interview Notes
Is Associated with an "F" Greater Than One

Prediction of Delay (Sample size = 78)

Entry Order	Variable	R	F
1 - 3	MCAT_Sci & Tot_GPA & #_Unfin	.47	6.9
4	FOCUS	.51	4.5

Prediction of # of Ns (Sample size = 70)

Entry Order	Variable	R	F
1 - 2	MCAT_Sci & Tot_GPA	.45	8.6
3	Motiv	.47	1.7